

Flood Inundation Mapping using GIS

National Severe Weather Workshop
March 5-7, 2009
Norman, OK

Moon H. Kim, USGS-WSC
Sally Pavlow, NOAA-NWS
Kevin Mickey, The Polis Center

Presentation Outline

- Introduction
 - Pilot Study Overview
 - Static Inundation Maps

Collaborative Effort

Silver Jackets: A Natural Hazard Mitigation Team

- City of Indianapolis
- Indianapolis Mapping and Geographic Infrastructure System
- **Indianapolis Museum of Art**
- Indiana Department of Homeland Security
- US Army Corps of Engineers
- Indiana Department of Natural Resources
- National Weather Service
- United States Geological Survey
- The Polis Center

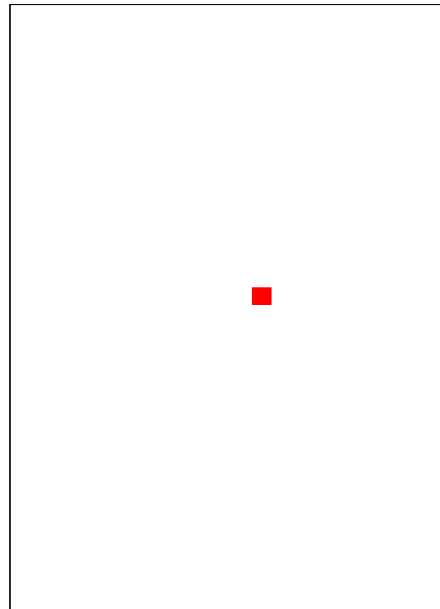


Pilot Study Objectives

- Generate current and forecast flood inundation maps: USGS and NWS data, 2D Hydraulic model (FastMECH)
- Generate flood maps for HAZUS-MH Analysis
- Serve flood maps (near-real-time) through Web

Study Area

- Ravenswood floods frequently
- Art and Nature Park occasionally floods
- Hi-Res DEMs, detailed building inventory, high water marks and other data is readily available



Products

- Web-based near-real-time flood inundation maps updated hourly.
- Web-based forecast maps updated every 6 hrs per NWS
- Downloadable flood maps for HAZUS-MH
- Results from the HAZUS-MH analysis
- USGS Report
- Evaluation of models/techniques

Web Mapping Application

Results

Map Contents

☐ depth20

☐ depth16

☒ depth12

☐ depth8

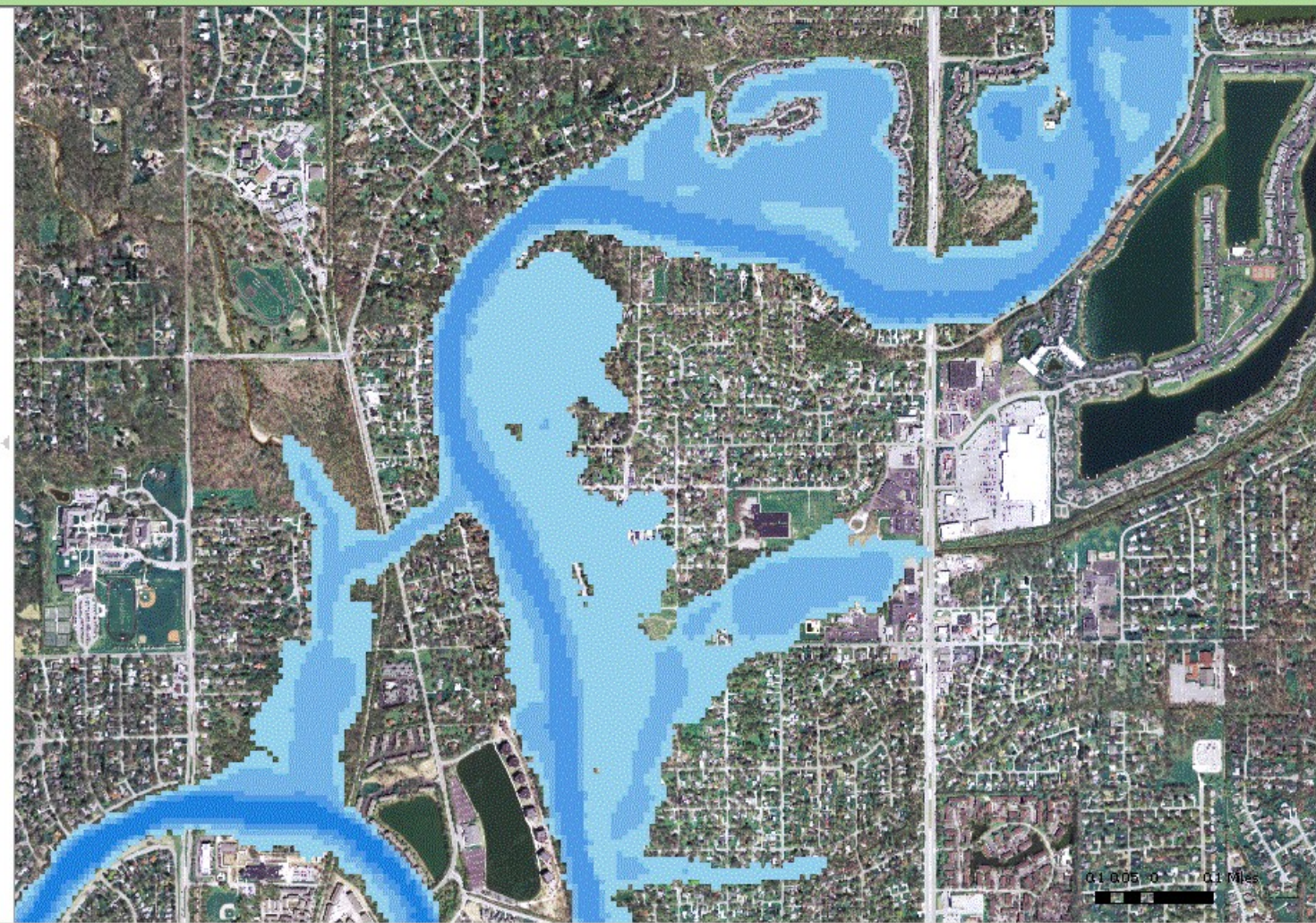
☐ depth4

☐ depth0

☐ time_grd

Navigation

Overview



HAZUS-MH Analysis

Ravenswood 8 year flood loss estimation

Click and wait ten seconds for response

Show Building Points

Show Community Profiles

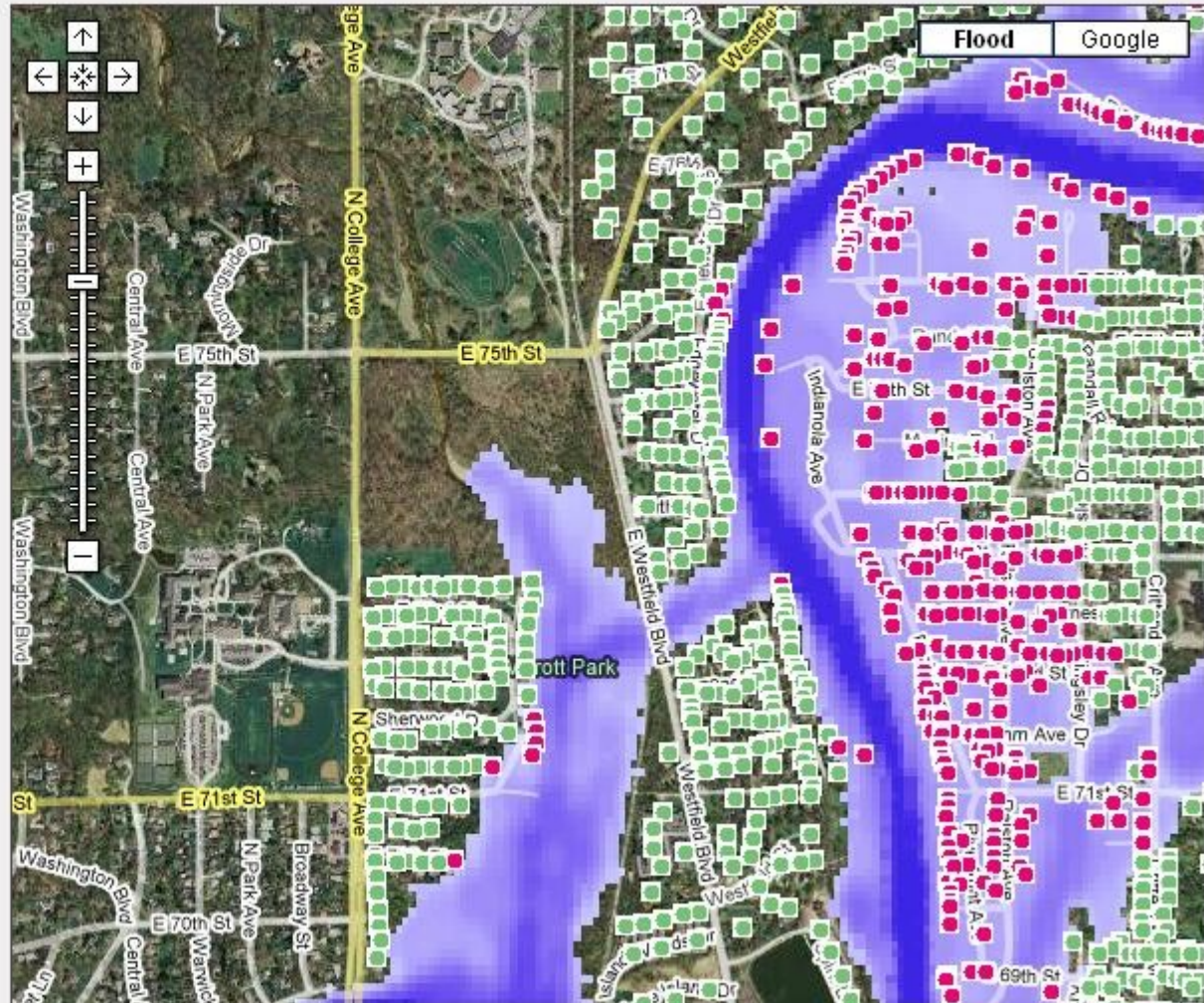
Clear Building Points and Community Profiles

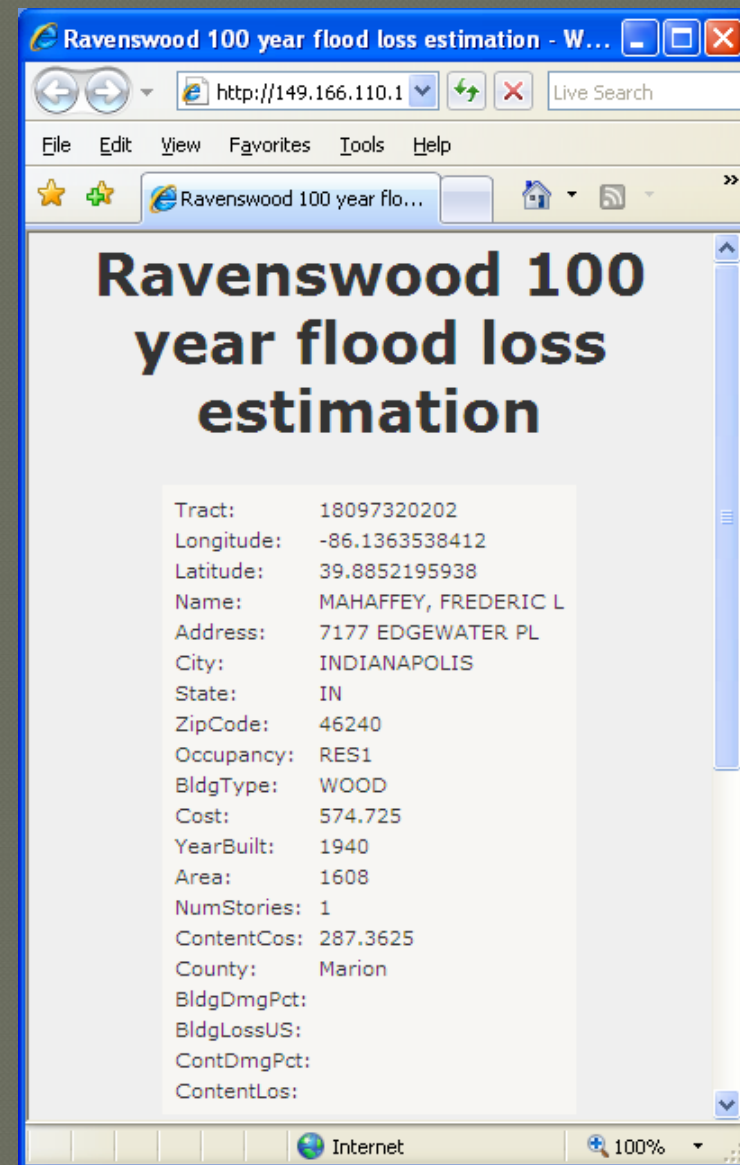
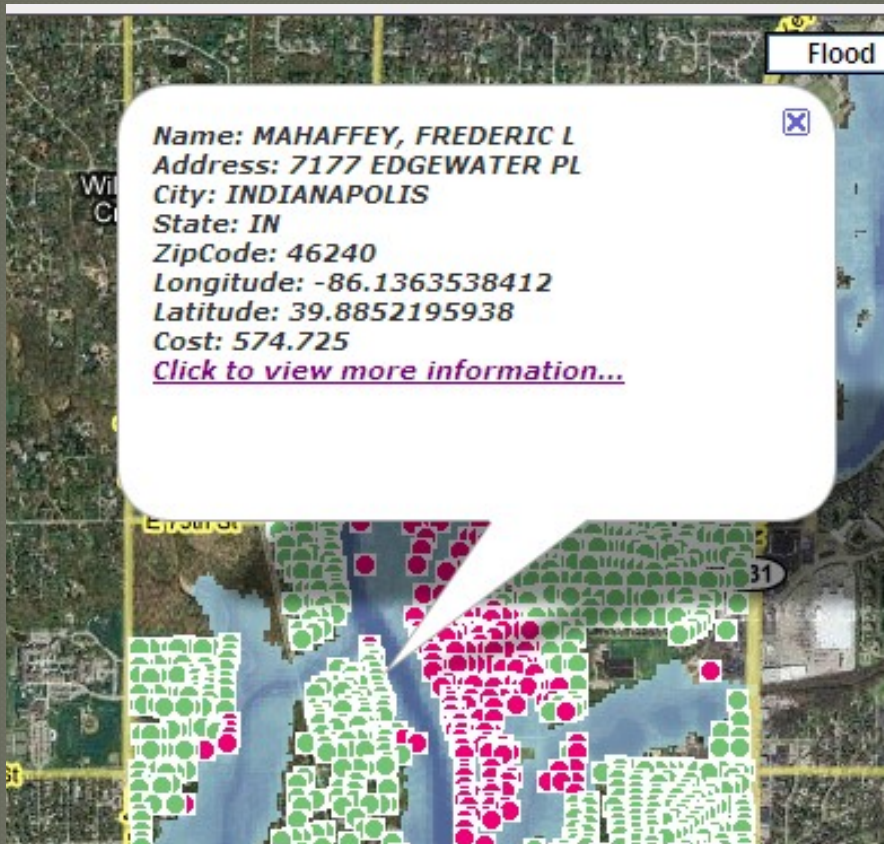
Ravenswood Buildings



Damaged

Undamaged





Static Inundation Maps

- NWS recognizes the need to improve flood risk communication
- Similar to static inundation maps currently available on AHPS
- Risk analysis through HAZUS-MH

2008 in Indiana

- 4 Major floods
- 2 Presidential Disaster Declarations



Approach

Grant proposal to IDHS

- USGS

- Engineering and analysis
- Scientific reports
- Comparing FastMECH output to HEC-RAS

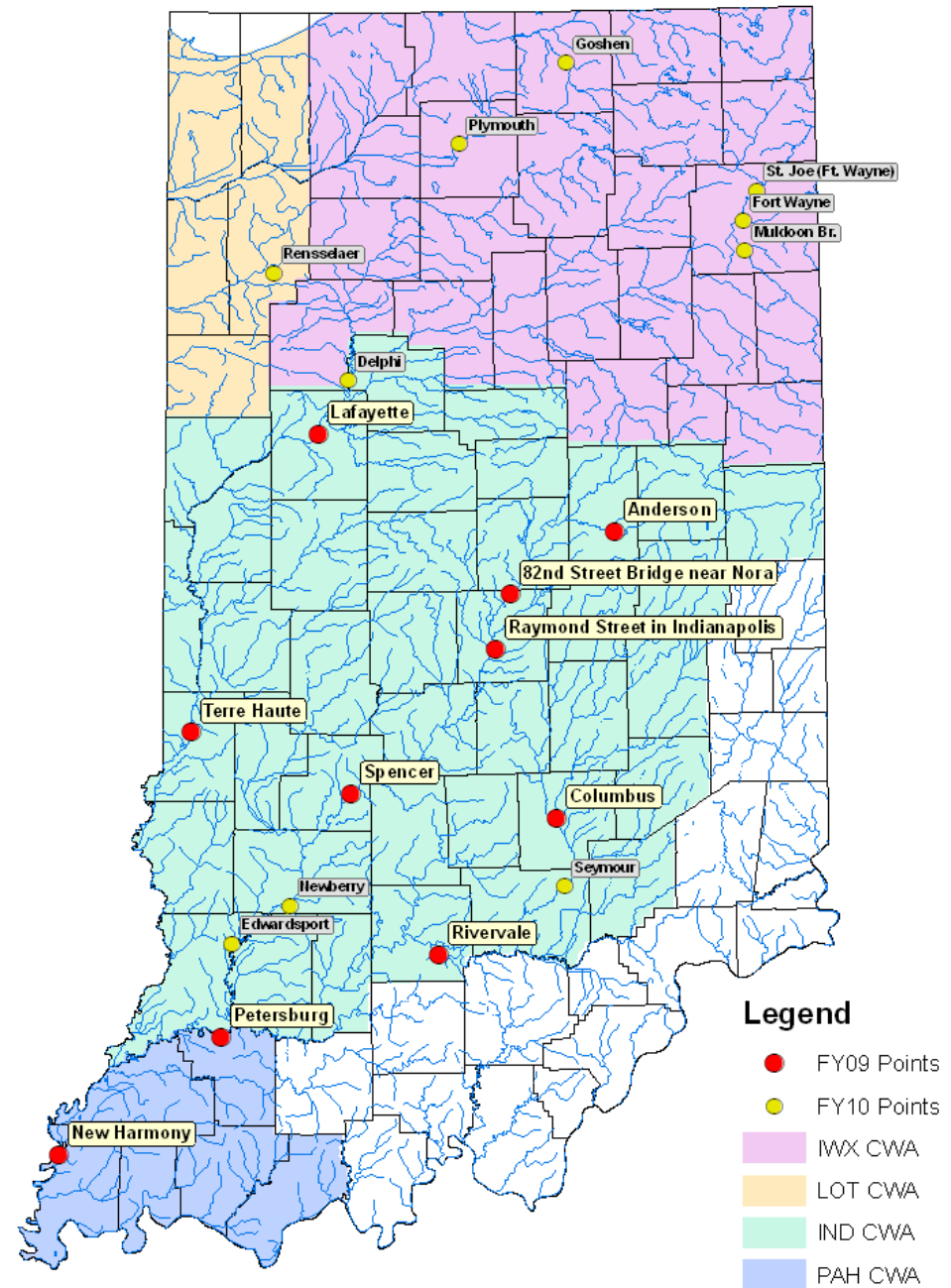
- Polis Center

- Education on HAZUS-MH

GIS expertise



Indiana Flood Inundation Map Points



Approach, cont'd

- NWS
 - NWSHQ – program management, experience with Tar River project
 - CRH/NWS – field expertise
- Highly organized process
 - Monthly conference calls
 - Detailed telcon protocol
- Deliverables
 - Map libraries will be sent to AHPS contractor

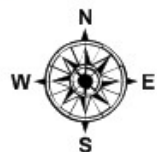


Results

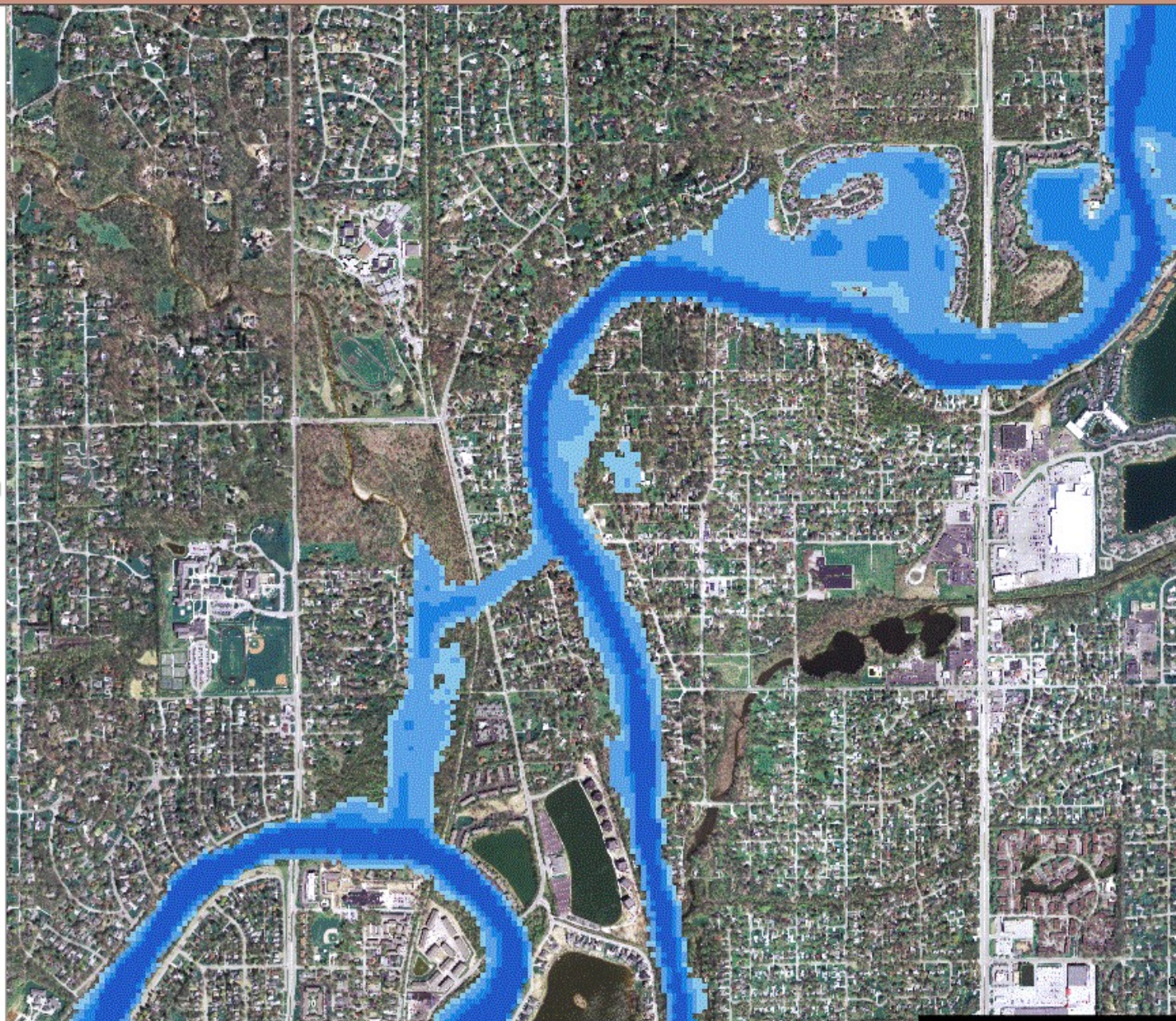
Map Contents

- ☐ Flood_Depth@15ft_Stage
- ☐ Flood_Depth@14ft_Stage
- ☐ Flood_Depth@13ft_Stage
- ☐ Flood_Depth@12ft_Stage
- ☒ Flood_Depth@Bankfull
- ☒ raywd.tif
- ☒ ima.tif

Navigation



Overview



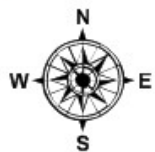


Results

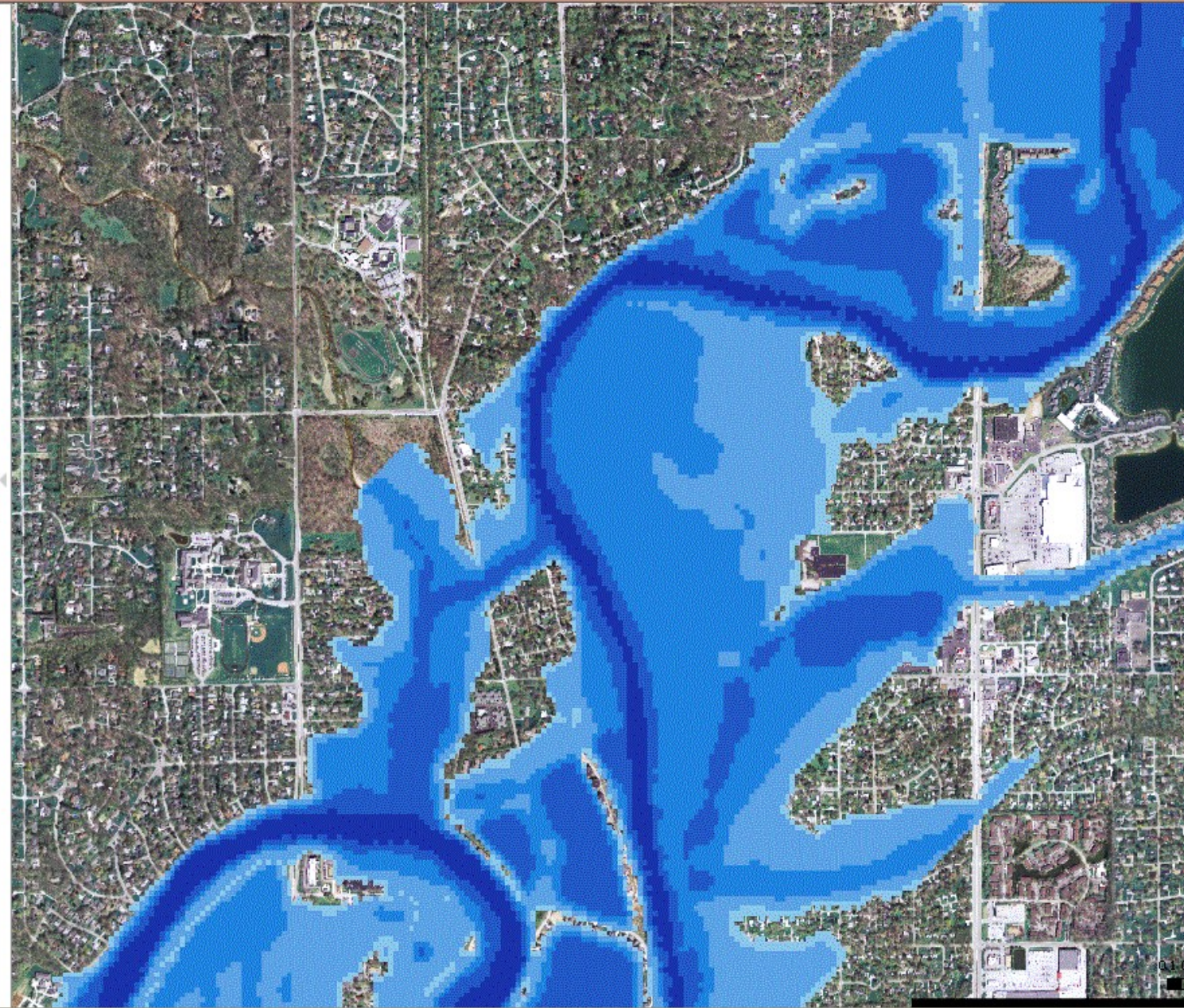
Map Contents

- ☒ static_map1/static_grid_tmp_v5
 - ☒ Flood_Depth@1913_Floor
 - ☐ Flood_Depth@21ft_Stage
 - ☐ Flood_Depth@20ft_Stage
 - ☐ Flood_Depth@19ft_Stage
 - ☐ Flood_Depth@18ft_Stage
 - ☐ Flood_Depth@17ft_Stage

Navigation



Overview



- ☒ Inundation Levels
- ☐ Flood Categories
- ☐ Current/Forecast

Hydrograph

River at a Glance

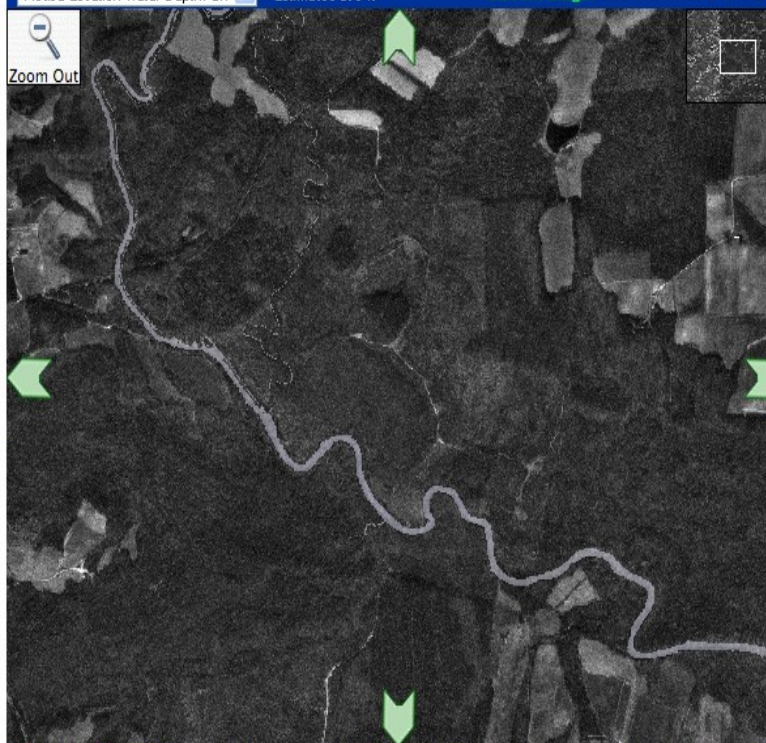
Download

Inundation
MappingImage Type: ☐ Standard (Faster Download) ☒ Detailed (Slower Download)

Mouse Location Water Depth: On

Estimated at 0 ft

Current Stage: 1.62 ft at 14:30 UTC 10/10

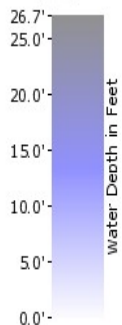
Transparency Level 100 Year Flood 500 Year N/A (See FAQ) Floodway Data**Selected Inundation**
NAVD88: 289.0 ft
Stage: 1.7 ft[Print / Save Image](#)
[About Inundation](#)
[Download Dataset\(s\)](#)
[FAQ](#)
[User Guide](#)
[Inundation Sites](#)**Mouse Location***

Water Depth: 0 ft

Latitude: 36.2013 N

Longitude: -78.6235 W

* All mouse location values are estimates only.



Water Depth in Feet

Flood Categories (in feet)

Major Flood Stage: 21

Moderate Flood Stage: 19

Flood Stage: 16

Action Stage: 15

Below Flood Stage: 1.7

☒ USGS Gauge Location

Extent of Inundation

Study Boundaries

[Return to Area Map](#)

Graphical representation of flood inundation for NWS flood categories are based on steady state hydraulic modeling of water surface elevations for incremented discharges. Map shows approximate inundation areas

Hydrograph

River at a Glance

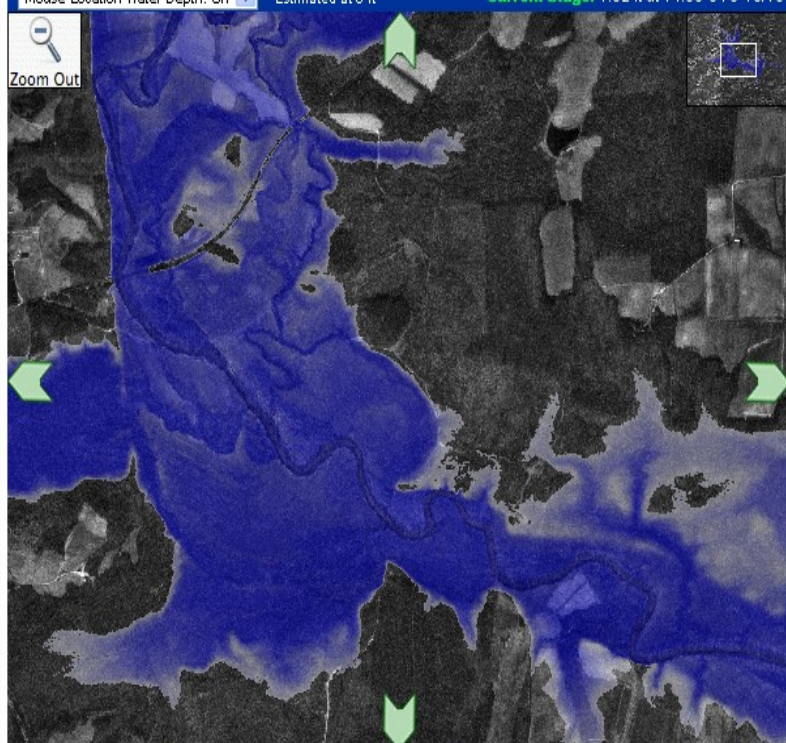
Download

Inundation
MappingImage Type: ☐ Standard (Faster Download) ☒ Detailed (Slower Download)

Mouse Location Water Depth: On

Estimated at 0 ft

Current Stage: 1.62 ft at 14:30 UTC 10/10

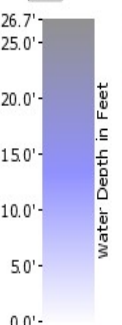
Transparency Level 100 Year Flood 500 Year N/A (See FAQ) Floodway Data**Selected Inundation**
NAVD88: 305.0 ft
Stage: 17.7 ft[Print / Save Image](#)
[About Inundation](#)
[Download Dataset\(s\)](#)
[FAQ](#)
[User Guide](#)
[Inundation Sites](#)**Mouse Location***

Water Depth: 0 ft

Latitude: 36.2013 N

Longitude: -78.6235 W

* All mouse location values are estimates only.



Water Depth in Feet

Flood Categories (in feet)

Major Flood Stage: 21

Moderate Flood Stage: 19

Flood Stage: 16

Action Stage: 15

Below Flood Stage: 1.7

☒ USGS Gauge Location

Extent of Inundation

Study Boundaries

[Return to Area Map](#)

Graphical representation of flood inundation for NWS flood categories are based on steady state hydraulic modeling of water surface elevations for incremented discharges. Map shows approximate inundation areas

Summary

- The partnerships cultivated during the original Pilot Study are KEY to the success of this project
- IDHS and all other partners have a vested interest in this project
- Using our partnerships to
 - Leverage financial resources
 - Expand technical expertise

Summary, cont'd

- Latest technologies used to provide flood information
- Integrates with widely used AHPS
- Maps allow officials to make decisions based on flood extents and depths
- Depth/Extent information + HAZUS analysis + response plans
 - Allows for protection of life and property *before* water reaches critical levels

Questions?

- Contact Information

- Moon Kim: mkim@usgs.gov
- Sally Pavlow: Sally.Pavlow@noaa.gov
- Kevin Mickey: kmickey@iupui.edu